

Experiment: Common Source Amplifier using diode connected load

Aim:

To implement a common source amplifier using diode connected load of gain 5 and analyze its transient and ac characteristics.

Tool Used:

LTspice

Theory:

The common-source (CS) amplifier for MOSFET is the analogue of the common emitter amplifier for BJT. Its popularity arises from its high gain, and that by cascading a number of them, larger amplification of the signal can be achieved.

For a Level 3 NMOS let's assume

$$V_{GS} = 0.6V$$

$$V_T = 0.4V$$

$$V_{DD} = 1.8V$$

$$K_n = 120\mu A/V^2,$$

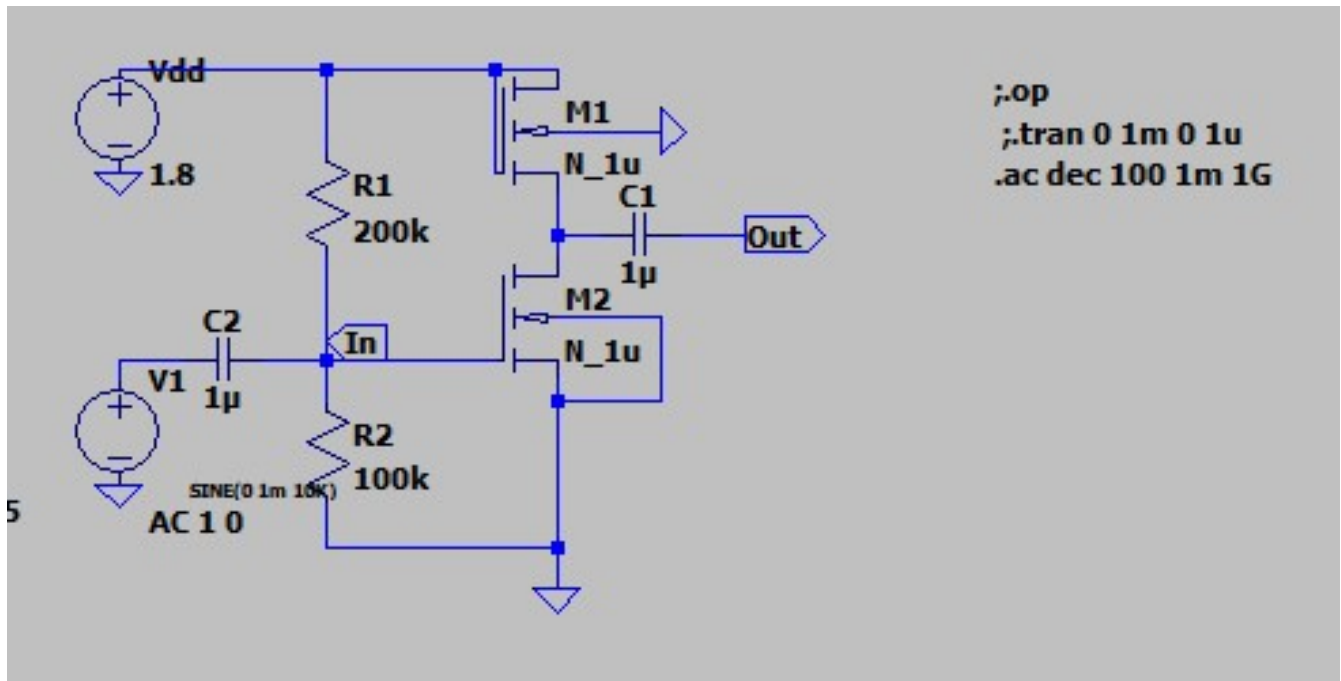
Which gives a value of $(W/L) = 25$ for $50\mu A I_D$.

The value of V_{DS} should be maintained above $(V_{GS} - V_T = 0.6 - 0.4 = 0.2V)$ for the transistor to stay in saturation region.

As W/L is 25, the width is taken as $250\mu m$ and the length is taken as $10\mu m$.

The W/L of diode mosfet is taken 25 times lesser.

Circuit Schematic:

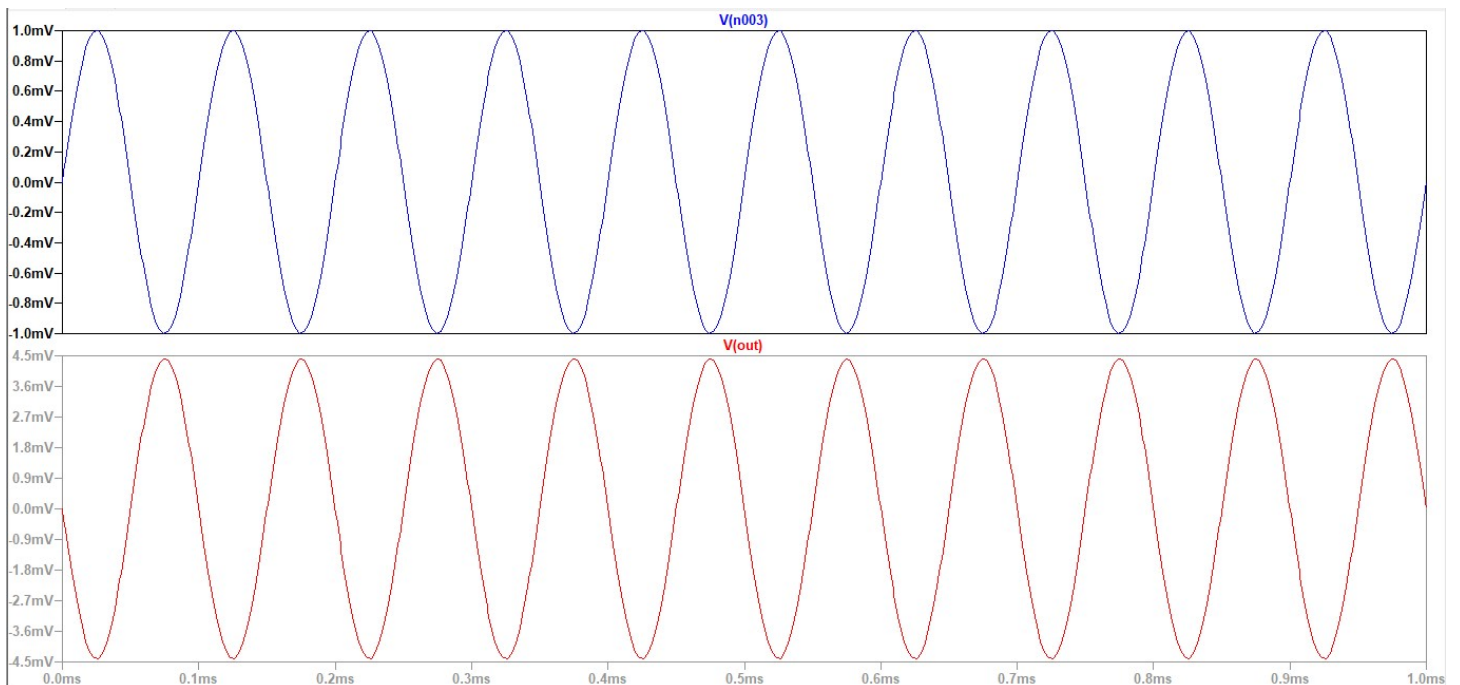


Output Waveforms:

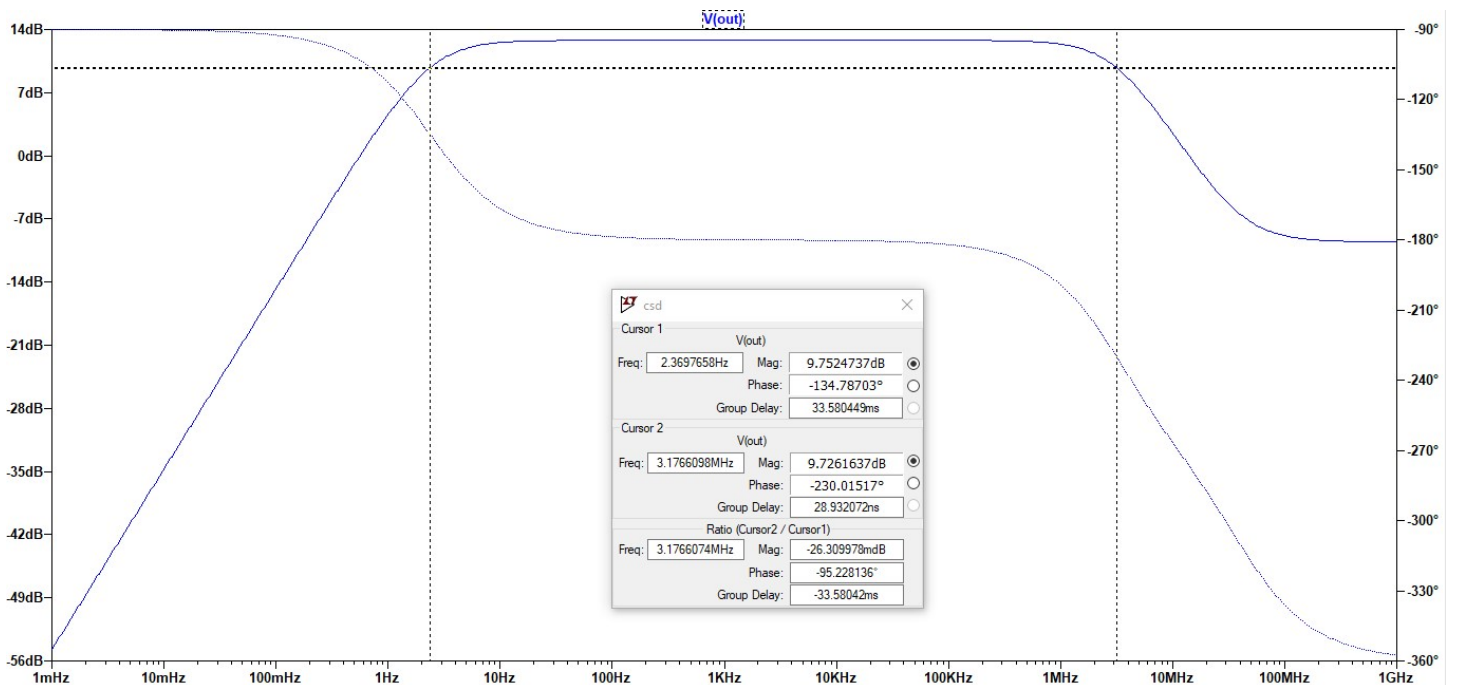
--- Operating Point ---

V(n001):	1.8	voltage
V(n002):	0.262348	voltage
V(in):	0.6	voltage
V(n003):	0	voltage
V(out):	2.62348e-007	voltage
Id(M2):	5.3556e-005	device_current
Ig(M2):	0	device_current
Ib(M2):	-2.72348e-013	device_current
Is(M2):	-5.3556e-005	device_current
Id(M1):	5.3556e-005	device_current
Ig(M1):	0	device_current
Ib(M1):	-2.08235e-012	device_current
Is(M1):	-5.3556e-005	device_current
I(C2):	6e-019	device_current
I(C1):	-2.62348e-019	device_current
I(R2):	6e-006	device_current
I(R1):	6e-006	device_current
I(V1):	6e-019	device_current
I(Vdd):	-5.9556e-005	device_current

Transient characteristics



AC Analysis



Result:

The circuit is designed for a gain of 5 and the output is verified to be correct.

- Bandwidth is obtained to be : 3.17MHz
- Cutoff Freq : 3.17MHz, 2.36Hz